REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 49-55 and 81-83 remain active in the application subsequent to entry of this Amendment.

In the Official Action claims 60-66 and 84-87 have been withdrawn as directed to non-elected subject matter which is consistent with the examiner's Action in the communication of April 16, 2003, Paper No. 6. In the instructions given above these claims have been withdrawn but without prejudice to divisional applications directed to subject matter defined in these claims.

In addition, in order to advance prosecution, claims 55-59 and 67-80 as well as 84-87 have been withdrawn.

In the above amendments independent claims 49, 51 and 81 are amended to specify that the electron-donating dye precursor and the electron-accepting compound are dispersed in the heat-sensitive recording layer. This feature is based upon corresponding description in the specification at page 17, lines 22 to 26 which states "various color-forming components ... are applied onto a substrate in the form of a dispersion of them in a dispersing medium and dried". Applicants explain that a dispersion of color-forming components is applied onto a substrate and dried, so that it is apparent that the electron-donating dye precursor and the electron-accepting compound are also dispersed in the obtained heat-sensitive recording layer.

This feature is further explained and illustrated at pages 70 to 74, where Dispersions A to W are prepared. In the preparation of these dispersions, color-forming components such as electron-donating dye-precursors and electron-accepting compounds are dispersed in dispersing media without being micro-encapsulated. The significance of this is explained below.

Heat-sensitive recording materials are of the following two types.

(i) A heat-sensitive recording material in which at least one of an electron-donating dye-precursor and an electron-accepting compound (color developer) is micro-

encapsulated then they are applied onto a substrate to form a heat-sensitive recording layer.

(ii) A heat-sensitive recording material in which neither the dye-precursor nor the electron-accepting compound (color developer) is micro-encapsulated -- they are simply applied onto a substrate to form a heat-sensitive recording layer.

In the heat-sensitive recording material of the above type (i), at least one of the dye-precursor and the electron-accepting compound (color developer) is micro-encapsulated, so that undesirable color formation caused by contact of these two members does not take place during storage. This arrangement avoids ground-fogging problems. In the heat-sensitive recording material of the type (i), printing is carried out by a procedure in which the microcapsules are melted with a thermal head to bring the dye precursor and the electron-accepting compound into contact with each other, followed by color formation.

In the heat-sensitive recording material of the above type (ii), neither the dye-precursor nor the electron-accepting compound (color developer) is micro-encapsulated. These two members may react with each other during storage particularly during storage under high-temperature and high-humidity conditions, to cause undesirable color formation. This gives rise to a ground-fogging problem. Further, it is not possible to obtain a high-density recorded image with a thermal head. Applicants discuss the defects of the heat-sensitive recording material of the type (ii) in their specification at page 2, lines 15 to 27.

The amended claims 49 and 51 overcome the above defects of the heat-sensitive recording material of the type (ii) by employing carefully selected components, that is using, as an electron-accepting compound, (A) at least one member selected from a compound of the general formula (I) in which a hydroxyl group is present on the o-position of a benzene ring and N,N'-bis(2-hydroxypheny)-4,4'-biphenyldisulfonamide[1]

[1] The compound specified in original claim 4 which was allowed in the Official Action of April 16, 2003 (Paper No. 6).

which also has a hydroxyl group on a benzene ring, and (B) at least one member selected from a diphenylmethane derivative, a benzoic acid derivative, a salicylic acid derivative and a urea derivative.

The improved thermal response produced by products defined by amended clams 49 and 51 will be apparent when Table 1, showing the results of Examples that are working examples within amended claim 49, is specifically compared with Table 2 showing results of Comparative Examples. To further illustrate this Tables A and B attached hereto show electron-accepting compounds used in Examples 12 to 23 and Comparative Examples 15 to 22 and 25 to 28.

First, Examples 12 to 14 in Table A use a compound of the general formula (I) as a first essential component and a diphenylmethane derivative as a second essential component, and according to Table 1 on page 85 of the present specification, the heat-sensitive recording materials in Examples 12 to 14 show thermal response data of 1.34, 1.30 and 1.33.

In contrast, Comparative Examples 15 to 17 in Table B use N-(3-hydroxyphenyl)-p-toluenesulfoneamide in place of the first essential component, in combination with a diphenylmethane derivative. The heat-sensitive recording materials in Comparative Examples 15 to 17 show thermal response data of 1.10, 1.12 and 1.10.

When Examples 12 to 14 are compared with Comparative Examples 15 to 17, it is clear that the amended claims 49 and 51 are directed to recording materials exhibiting excellent thermal response when using the compound of the general formula (I) as a first essential component and a diphenylmethane derivative as a second essential component.

The excellent thermal response of the amended claims 49 and 51 will be also clear when Examples 15 and 16 using a benzoic acid derivative are compared with Comparative Examples 18 and 19, when Examples 17 to 19 using a salicylic acid derivative are compared with Comparative Examples 20 to 22, and further when Examples 20 to 23 using a urea derivative are compared with Comparative Examples 25 to 28.

In items 2 and 3 of the current Official Action the examiner is of the opinion that Usami US '376 teaches a heat-sensitive recording material which can employ N-(2-hydroxyphenyl)-p-toluene sulfonamide as a color developer. A closer reading of the reference will reveal this is not correct.

It will be observed that Usami US '376, column 8, line 58 et seq., describes phenol compounds as a color developer, whereas the above compound described in column 7, lines 9-10 is used not as a color developer but as a glass transition point modifier (see column 6, line 32).

In the heat-sensitive recording material described in Usami US '376, at least the first component capable of undergoing a color reaction (that is, dye precursor) is micro-encapsulated as is clear from claim 1 of this reference, thus the heat-sensitive recording material of Usami US '376 comes under the heat-sensitive recording material of the above type (i) and hence does not inherently have the above technical problems of the heat-sensitive recording material of the type (ii) to which applicants' claims are directed.

Therefore, amended clams 49 and 51 are neither anticipated by, nor obvious over, Usami US '376 that discloses the heat-sensitive recording material of the different type.

Claim 1 of each of Nakamura JP 01-141786 and Nakamura JP 02-145560 discloses a recording material containing a compound of the formula (I) in which a hydroxyl group is substituted on the o-, m- or p-position of a phenyl ring, as an electron-accepting compound. In all of electron-accepting compounds in Examples 1 to 10 specifically described in Table 1 (see attached translation) of Nakamura JP '786, a hydroxyl group is substituted on p- or m-position of a phenyl ring – there is no electron-accepting compound having a hydroxyl group substituted on the o-position of the phenyl ring. Further, in all of electron-accepting compounds in Synthesis Examples 1 to 15 specifically described in Table 1 (translation attached) of Nakamura JP '560, a hydroxyl group is substituted on p– or m-position of a phenyl ring as well – there is no electron-accepting compound having a hydroxyl group substituted on the o-position of the phenyl ring thereof, either.

Applicants submit that Nakamura JP '786 and JP '560 substantially do not disclose any of the compounds of the general formula (I) nor N,N'-bis(2-hydroxypheny)-4,4'-biphenyldisulfonamide used as electron-accepting compounds in amended claims 49 and 51.

Moreover, Nakamura JP '786 and JP '560 do not disclose "at least one electron-accepting compound (B) selected from a diphenylmethane derivative, a benzoic acid derivative, a salicylic acid derivative and a urea derivative", which is also an essential component together with at least one electron-accepting compound (A) selected from the compound of the general formula (I) and N,N'-bis(2-hydroxypheny)-4,4'-biphenyldisulfonamide in amended claims 49 and 51.

Applicants have found and are able to demonstrate that by employing the above electron-accepting compounds (A) and (B) in combination, the product of amended claims 49 and 51 produces desirable and unexpected effects, namely the above-explained prevention of ground fogging and improvements in thermal response. Amended claims 49 and 51 are neither anticipated by nor obvious over, Nakamura JP '786 and JP '560 which disclose nothing concerning the above effects. Claims 50 and 52-55 are similarly patentable by virtue of their dependency from claims 49 and 51, respectively.

Amended claim 81 is directed to a heat-sensitive recording material in which an electron-donating dye precursor and an electron-accepting compound are dispersed in a heat-sensitive recording layer, where the substrate contains a *non*-wood pulp and a benzenesulfonamide derivative, a diphenylsulfonamide derivative, a benzoic acid derivative or a diphenylmethane derivative is used as the electron-accepting compound. The technical effect of the heat-sensitive recording material of the amended claim 81 is high thermal response as demonstrated in Table 15 of the specification. To illustrate this point and isolate the relevant data Tables C and D attached hereto show electron-accepting compounds used in Examples 99 to 101 and Comparative Examples 59 to 61 and type of pulp (wood pulp or non-wood pulp) used in these Examples and Comparative Examples.

First, in Example 99 in Table C, the electron-accepting compound is 4-hydroxy-4'-isopropxy-diphenylsulfone that comes under the diphenylsulfone derivative specified in the amended claim 81, and the pulp is a non-wood pulp (100 % bagasse pulp). According to Table 15 on page 150 of the present specification, the thermal response value in Example 99 is 1.27.

In contrast, in Comparative Example 59 in Table D, the electron-accepting compound is the same as that in the above Example 99, but the pulp is a wood pulp (100 % LBKP). According to Table 15 in the present specification, the thermal response value in Comparative Example 59 is 1.11.

It is therefore seen that when the electron-accepting compound is a diphenylsulfoneamide derivative, using a non-wood pulp as a substrate gives a higher thermal response than using a wood pulp.

Similarly, the above effect can be clearly seen when Examples 100 and 101 using a benzoic acid derivative (benzyl-4-hdyroxybenzoate) and a dephenylmethane derivative (2,2-bis(4-hydroxyphenyl)propane) specified as an electron-accepting compound in the amended claim 81 and using a non-wood pulp are compared with Comparative Examples 60 and 61 using a wood pulp.

In contrast to the present invention, Usami US '376 is directed to a heat-sensitive recording material in which at least a color forming component (dye precursor) is micro-encapsulated hence this reference lacks technical relevance to the amended claim 81 for the above reasons. Therefore, the amended claim 81 is neither anticipated by, nor obvious over, Usami US '386.

Further, Nakamura JP '786 and JP '560 disclose nothing concerning the use of a non-wood pulp for a substrate and the use of a benzenesulfonamide derivative, a diphenylsulfonamide derivative, a benzoic acid derivative or a diphenylmethane derivative as an electron-accepting compound. Therefore, the amended claim 81 is neither anticipated by, nor obvious over, the two Nakamura patents.

For the above reasons it is respectfully submitted that the claims of this application define inventive subject matter. Reconsideration and allowance are solicited.

Respectfully submitted,

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Table A

	1st essential component	2nd essential component				Optional component		
Examples	Compound of the general formula (I)	diphenyl-methane derivative	benzoic acid derivative	Salicylic acid derivative	Urea derivative	phosphoric ester derivative	N-(3-hydroxyphenyl)-p-toluenesulfonamide	N-(4-hydroxyphenyl)-p-toluenesulfonamide
12	O	O	X	X	X	X	X	X
13	O	O	X	X	X	X	X	X
14	O	O	X	X	X	X	X	X
15	O	X	O	X	X	X	X	X
16	O	X	O	X	X	X	X	X
17	O	X	X	O	X	X	X	X
18	O	X	X	O	X	X	X	X
19	O	X	X	O	X	X	X	X
20	O	X	X	X	O	X	X	X
21	O	X	X	X	O	X	X	X
22	O	X	X	X	O	X	X	X
23	O	X	X	X	O	X	X	X

O : contained X: not contained

Table B

	1st essential component	2nd essential component				Optional component		
CEx.	Compound of the general formula (I)	diphenyl-methane derivative	benzoic acid derivative	Salicylic acid derivative	Urea derivative	phosphoric ester derivative	N-(3-hydroxyphenyl)-p-toluenesulfonamide	N-(4-hydroxyphenyl)-p-toluenesulfonamide
15	X	O	X	X	X	X	O	X
16	X	O	X	X	X	X	O	X
17	X	O	X	X	X	X	O	X
18	X	X	O	X	X	X	O	X
19	X	X	O	X	X	X	O	X
20	X	X	X	O	X	X	O	X
21	X	X	X	O	X	X	O	X
22	X	X	X	O	X	X	O	X
25	X	X	X	X	O	X	X	O
26	X	X	X	X	O	X	X	O
27	X	X	X	X	O	X	X	O
28	X	X	X	X	O	X	X	O

CEx. = Comparative Examples

O : contained X: not contained

Table C

Examples	Diphenylsulfone derivative	Benzoic acid derivative	Diphenylmethane derivative	kind of pulp
	4-hydroxy-4'-isopropyloxy-diphenylsulfone	benzyl 4-hydroxy-benzoate	2,2-bis(4-hydroxyphenyl)-propane	
99	O			non-wood pulp 100 %
100		O		non-wood pulp 100 %
101			O	non-wood pulp 100 %

O : contained

Table D

Comparative Examples	Diphenylsulfone derivative	Benzoic acid derivative	Diphenylmethane derivative	kind of pulp
	4-hydroxy-4'-isopropyloxy-diphenylsulfone	benzyl 4-hydroxy-benzoate	2,2-bis(4-hydroxyphenyl)-propane	
59	O			wood pulp 100 %
60		O		wood pulp 100 %
61			O	wood pulp 100 %

O : contained